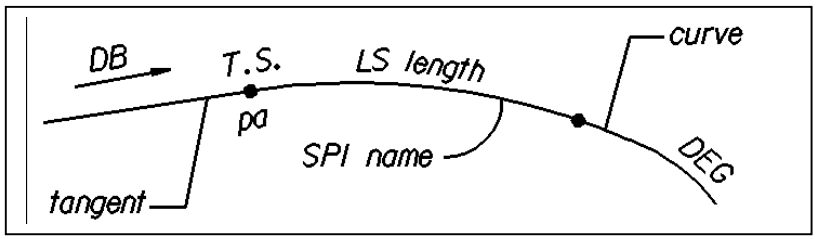
+SPIRAL COMMANDS

This group of store commands stores spiral curves from a tangent to a circular curve define by a degree of curvature or a radius (FORMATS A &B)
NOTE: When the spiral turns to the left from the tangent, a negative length of spiral is entered.

COMMAND LINE SYNTAX FOR TYPE-1 SPIRALS

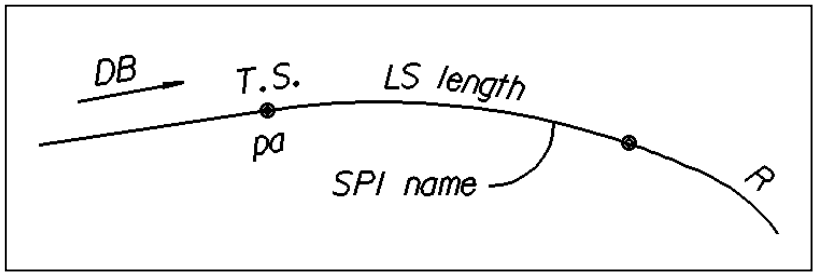
FORMAT A. Spiral name, type 1, stored by way of DB (direction back) , TS (tangent-spiral point), LS (length of spiral) and DEG (degree of curvature at the end of the spiral).



[1] STORE SPIRAL name [2] DB direction [3] TS pa [4] LS length [5] DEGREE angle [6] (sta-label station) [7] (CHORD)

S SPI S13B DB N 16 52 32.01 E TS 15 LS 300 DEG 3 00 TS 16+89.21

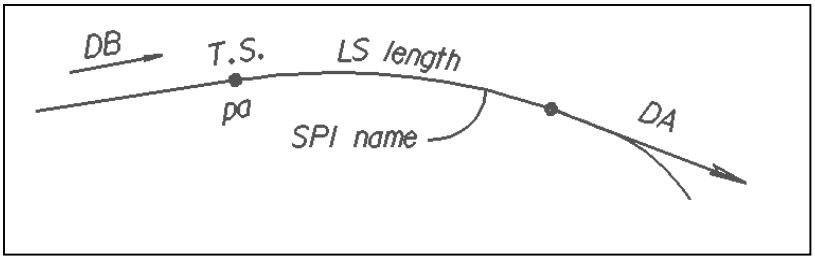
FORMAT B. Spiral name, type 1, stored by way of DB (direction back) , TS (tangent-spiral point), LS (length of spiral) , R (radius of curvature at the end of the spiral)



[1] STORE SPIRAL name [2] DB direction [3] TS pa [4] LS length [5] R radius [6] (sta-label station) [7] (CHORD)

S SPI S13B DB N 16 52 32.01 E TS 15 LS 300 R 1637.0223

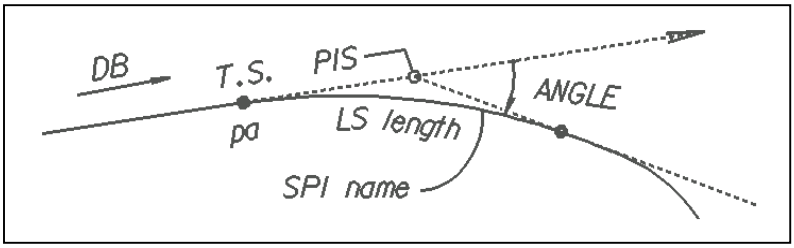
FORMAT C. Spiral name, type 1, stored by way of DB (direction back) , TS (tangent-spiral point), LS (length of spiral) , and DA (direction ahead at the end of the spiral)



[1] STORE SPIRAL name [2] DB direction [3] TS pa [4] LS length [5] DA direction [6] (sta-label station) [7] (CHORD)

S SPI S13B DB N 16 52 32.01 E TS 15 LS 300 DA N 11 02 28.01 W

FORMAT D. Spiral name, type 1, stored by way of DB (direction back) , TS (tangent-spiral point), LS (length of spiral) , and ANG (spiral angle).



[1] STORE SPIRAL name [2] DB direction [3] TS pa [4] LS length [5] ANG angle [6] (sta-label station) [7] (CHORD)

S SPI S13B DB N 16 52 32.01 E TS 15 LS 300 ANG 7 00 00.00 LT

NOTE: IF there is a previously store point or curve the DB can be defined:

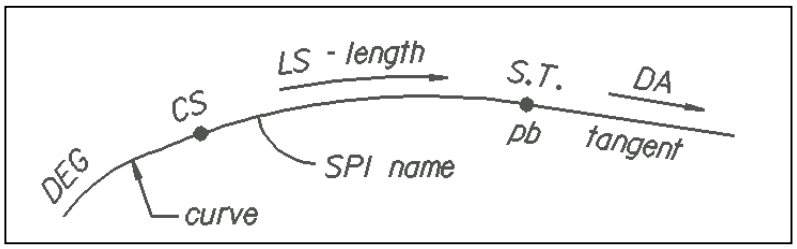
	DB 10 15	**(stored point 10 to stored point 15)**
Or	**DB PI CUR C1 PC CUR CI**	**(from PI of curve C1 to the PC of curve C1)**

COMMAND LINE SYNTAX FOR TYPE-2 SPIRALS

This group of Store Spiral commands stores spiral curves from a circular curve to a tangent. The circular curve is defined by a degree of curvature or a radius (FORMATS A2 &B2)

NOTE: When the spiral turnes to the left from the tangent, a negative length of spiral is entered.

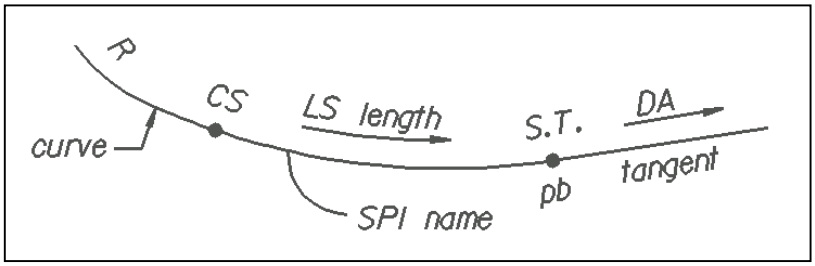
FORMAT A2. Spiral name, type 2, stored by way of DA (direction ahead), ST (spiral-tangent point), LS (length of spiral and DEG (degree of curvature)



[1] STORE SPIRAL name [2] DA direction [3] ST pa [4] LS length [5] DEGREE angle [6] (sta-label station) [7] (CHORD)

S SPI S13A DA N 05 47 28.01 W ST 16 LS 300 DEG 3 00 STA 28+36.83

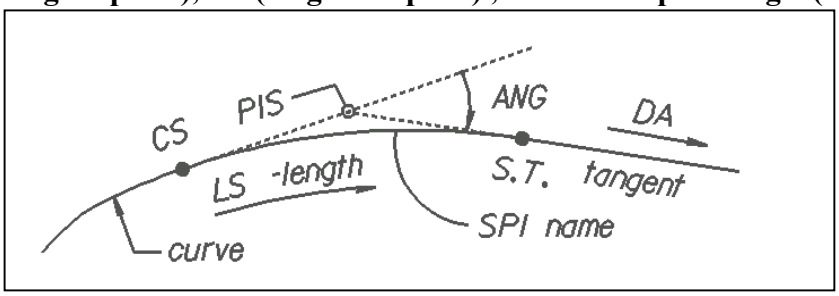
FORMAT B2. Spiral name, type 2, stored by way of DA (direction ahead), ST (spiral-tangent point), LS (length of spiral and DEG (degree of curvature)



[1] STORE SPIRAL name [2] DA direction [3] ST pa [4] LS length [5] R radius [6] (sta-label station) [7] (CHORD)

S SPI S13A DA N 16 52 32.01 E ST 15 LS 300 R 1637.0223

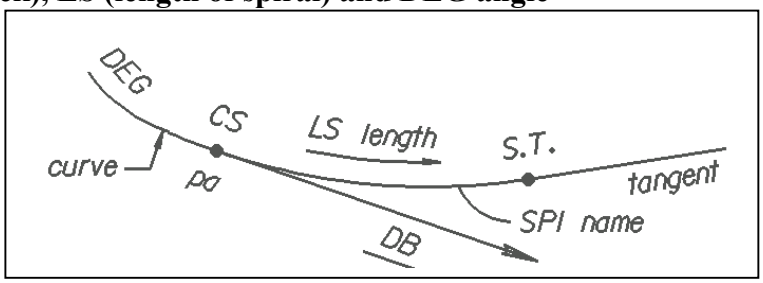
FORMAT C2. Spiral name, type 2, stored by way of DA (direction ahead) , ST (spiral-tangent point), LS (length of spiral) , and ANG spiral angle (clockwise)



[1] STORE SPIRAL name [2] DA direction [3] ST pa [4] LS length [5] ANG angle [6] (sta-label station) [7] (CHORD)

S SPI S13A DA N 16 52 32.01 ST 15 LS 300 ANG 5 15 LT

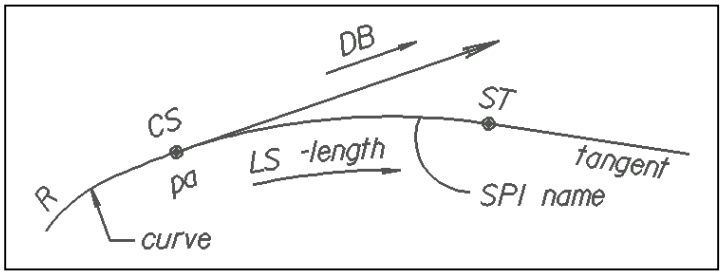
FORMAT D2. Spiral name, type 2, stored by way of CS (curve-spiral point), DB (direction back), LS (length of spiral) and DEG angle



[1] STORE SPIRAL name [2] CS pb [3] DB direction [4] LS length [5] DEGREE angle [6] (sta-label station) [7] (CHORD)

S SPI S13A CS 14 DB N 09 52 32.01 E LS -300 DEG 3 30

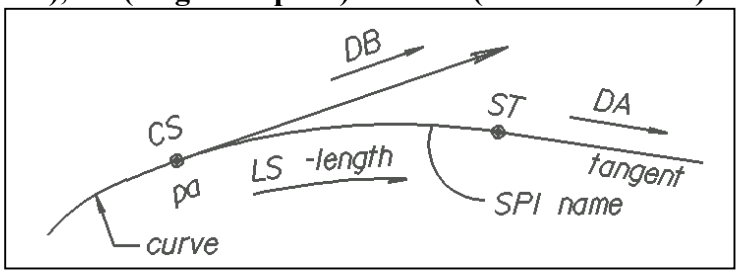
FORMAT E2. Spiral name, type 2, stored by way of CS (curve-spiral point), DB (direction back), LS (length of spiral) and R radius



[1] STORE SPIRAL name [2] CS pb [3] DB direction [4] LS length [5] R radius [6] (sta-label station) [7] (CHORD)

S SPI S13A CS 14 DB N 09 52 32.01 E LS –300 R 1637.022

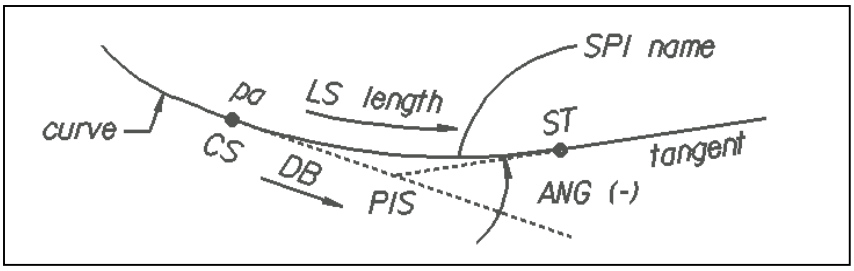
FORMAT F2. Spiral name, type 2, stored by way of CS (curve-spiral point), DB (direction back), LS (length of spiral) and DA (direction ahead)



[1] STORE SPIRAL name [2] CS pb [3] DB direction [4] LS length [5] DA direction [6] (sta-label station) [7] (CHORD)

S SPI S13A CS 14 DB N 09 52 32.01 E LS -300 DA N 05 47 28.01 W

FORMAT G2. Spiral name, type 2, stored by way of CS (curve-spiral point), DB (direction back), LS (length of spiral) and DEG angle



[1] STORE SPIRAL name [2] CS pb [3] DB direction [4] LS length [5] ANGLE angle [6] (sta-label station) [7] (CHORD)

S SPI S13A CS 14 DB N 09 52 32.01 E LS 300 ANG - 5 15 00.00

NOTE: IF there is a previously store point 10 or curve C1 the DB can be defined:

DB 10 15 **(stored point 10 to stored point 15)**
Or DB PI CUR C1 TO PC CUR C2 (from PI of curve C1 to the PC of curve C2)

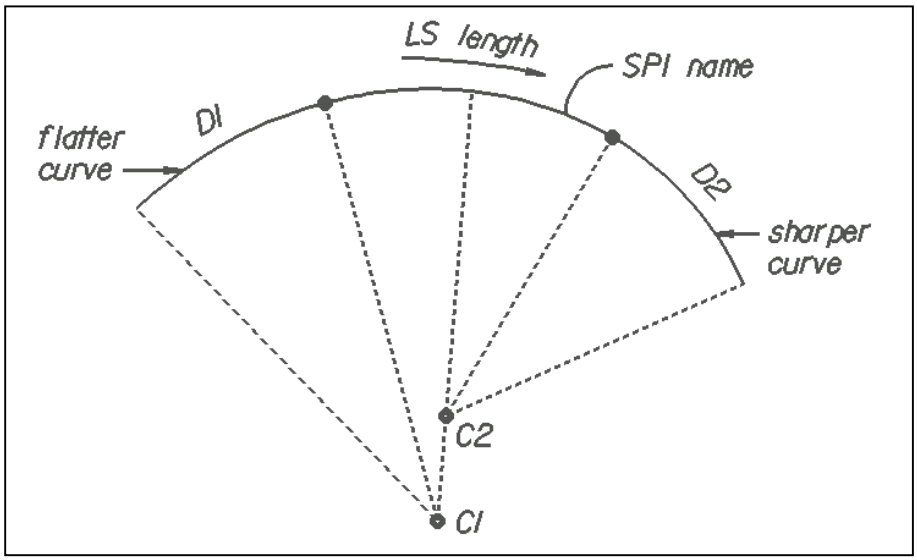
IF there is a previously store point or curve the DA can be defined:
DA SPI S13a 20 **(PIS of spiral S13a to stored point 20)**
Or DA PI 20 TO PI 30 **(PI of curve to PI of curve or stored point)**

STORE SPIRAL TYPE 3

This group of STORE SPIRAL commands stores spiral curves from a flatter curve (DI) to s sharper curve (D2). NOTE: When the spiral turnes to the left from the tangent of the flatter curve to the tangent of the sharper curve, a negative length of spiral is entered.

COMMAND LINE SYNTAX FOR TYPE-3A SPIRALS. Format A3 requires the centers of two curves(C1 and C2)

FORMAT A3. Spiral name , type 3, stored by way of D1 (degree of curvature of the flatter curve), LS (length of spiral), D2 (degree of curvature of the sharper curve, C1 (center point of the flatter curve, and C2 (center point of the sharper curve).



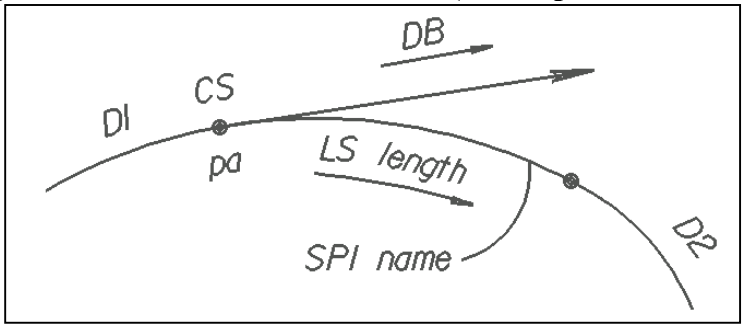
[1] STORE SPIRAL name [2] D1 angle [3] LS length [4] D2 angle
[5] C1 *pa* C2 *pb* [6] (sta-label station) [7] (CHORD)

S SPI C4B DI 16 52 00.00 LS 300 D2 54 30 29.99 C1 30 C2 40 CS 16+89.21

COMMAND LINE SYNTAX FOR TYPE-3B and TYPE-3C SPIRALS.

When the centers are unknown Formats B3 and C3 are used.

FORMAT B3. Spiral name , type 3, stored by way of D1 (degree of curvature of the flatter curve), LS (length of spiral), D2 (degree of curvature of the sharper curve, C1 (center point of the flatter curve, and C2 (center point of the sharper curve).

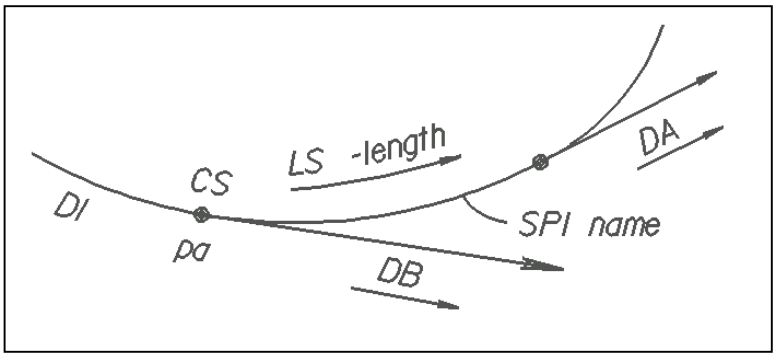


[1] STORE SPIRAL name [2] D1 angle [3] CS pa [4] DB direction [5] LS length [6] D2 angle [7] (sta-label station) [8] (CHORD)

S SPI C4B DI 16 52 00.00 CS 28 DB N 30 26 00.00 W LS 300 D2 54 30 29.99

FORMAT C3. Spiral name , type 3, stored by way of D1 (degree of curvature of the flatter curve), LS (length of spiral), D2 (degree of curvature of the sharper curve, C1 (center point of the flatter curve, and C2 (center point of the sharper curve).

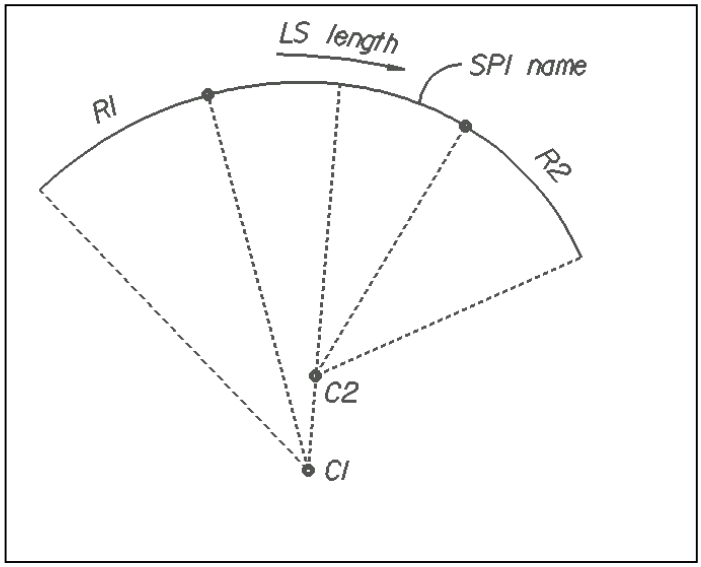
[1] STORE SPIRAL name [2] D1 angle [3] CS pa [4] DB direction [5] LS length [6] DA direction [7] (sta-label station) [8] (CHORD)



S SPI C4B DI 16 52 00.00 CS N 487005.8122 E 687548.0832 DB N 30 26 00.00 W LS -300 DA N 39 04 29.99 E

R1 - COMMAND LINE SYNTAX FOR TYPE-3D THRU TYPE-3F SPIRALS. Formats D3 thru 3F apply when radius R1 and R2 are given.

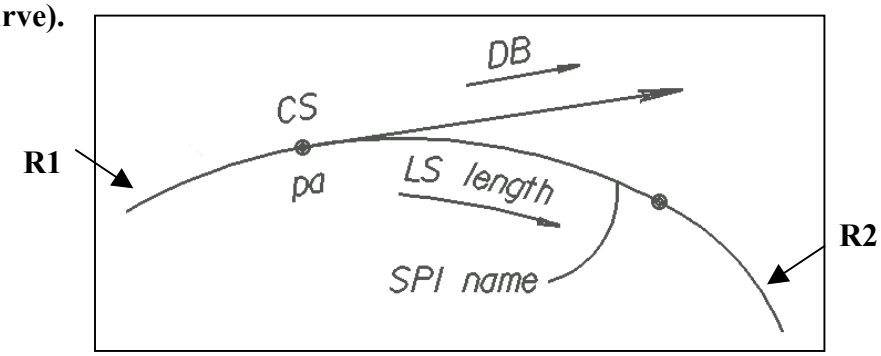
FROMAT 3D. Spiral name, type 3 stored by way of R1 (radius of the flatter curve), LS (length of spiral), R2 (radius of sharper curve), C1 (center point of flatter curve) and C2 (center point of sharper curve).



[1] STORE SPIRAL name [2] R1 radius [3] CS *pb* [4] LS length [5] R2 radius [6] C1 *pa* C2 *pb* [7] (sta-label station) [8] (CHORD)

S SPI C4B R1 1909.8593 CS 42 LS -300 LS –300 R2 1145.9156 C1 33 C2 43

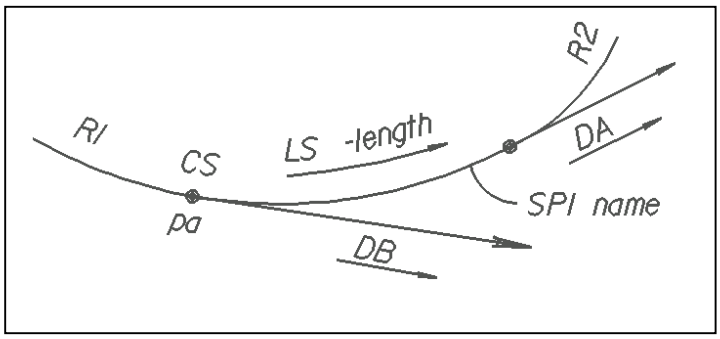
FROMAT 3E. Spiral name , type 3, stored by way of R1 (radius of flatter curve) CS (curve-spiral point), DB (direction back), LS (length of spiral), and R2 (radius of sharper curve).



[1] STORE SPIRAL name [2] R1 radius [3] CS *pa* [4] DB direction [5] LS length [6] R2 radius [7] (sta-label station) [8] (CHORD)

S SPI C4B R1 1909.8593 CS 28 DB N 30 26 00.00 W LS 300 R2 1145.9156

FROMAT 3F. Spiral name, type 3, stored by way of R1 (radius of flatter curve), CS (curve-spiral point), DB (direction back), LS (length of spiral and DA (direction ahead).

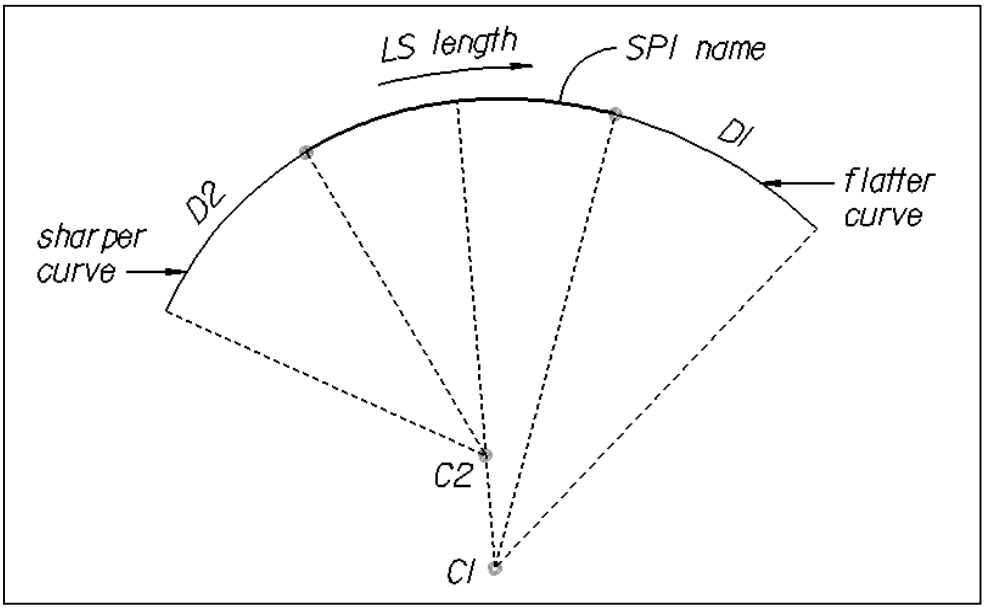


[1] STORE SPIRAL name [2] R1 angle [3] CS *pa* [4] DB direction [5] LS length [6] DA direction [7] (sta-label station) [8] (CHORD)

S SPI C4B R1 1909.8593 CS 28 DB N 30 26 00.00 W LS -300 DA N 05 47 28.01 W

<u>COMMAND LINE SYNTAX FOR TYPE-4 SPIRALS</u>. This group of Store Spiral commands stores spiral curves from a sharper curve (D2) to a flatter curve (D1).

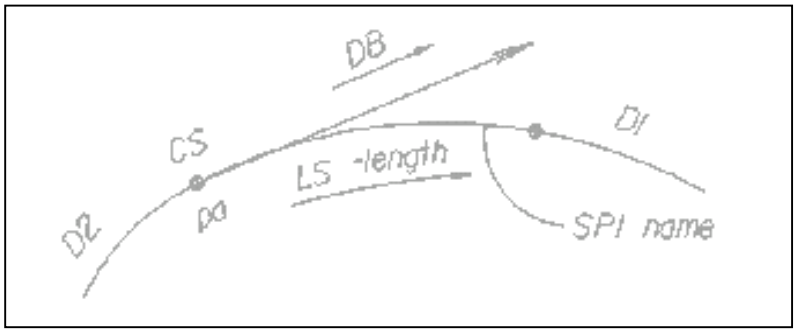
FORMAT 4A: <u>This requires the stored center of two curves (C1 and C2).</u>
Spiral name, type 4, stored by way of D2 (degree of curvature of the sharper curve), LS (length of spiral), D1 (degree of curvature of flatter curve), C2 (centerpoint of sharper curve) and C1 (center point of flatter curve). <u>Use FORMAT 4D to replace degree with radius.</u>



[1] <u>S</u>TORE <u>SPI</u>RAL <u>name</u> [2] <u>D2 angle</u> [3] <u>LS length</u> [4] <u>D1 angle</u> [5] <u>C2</u> *<u>pa</u>* [6] <u>C1</u> *<u>pb</u>* [7] (<u>sta-label station</u>) [8] (<u>CHORD</u>)

S SPI C4B D2 54 30 39.99 LS 300 D1 16 52 00.00 C2 40 C1 30 CS 16+89.21

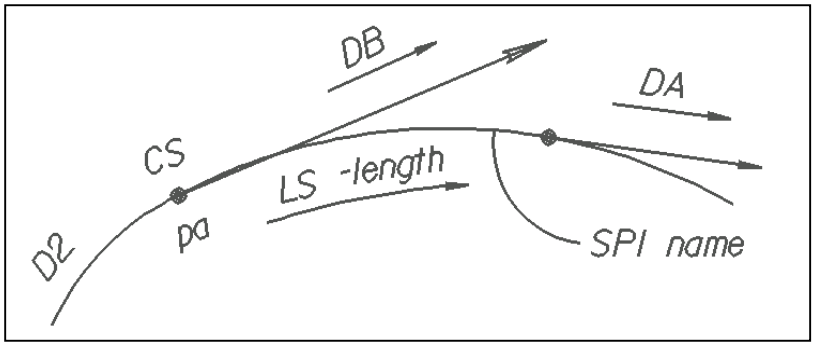
FORMAT 4B. Spiral name, type 4, stored by way of D2 (degree of curvature of sharper curve), CS (curve-spiral point), DB (direction back), LS (length of spiral), and D1 (degree of curvature of the flatter curve). Use FORMAT 4E. to replace degree with radius.



[1] STORE SPIRAL name [2] D2 angle [3] CS *pa* [4] DB direction [5] LS length [6] D1 angle [7] (sta-label station) [8] (CHORD)

S SPI C4B D2 54 30 29.99 CS 28 DB N 30 26 00.00 LS –300 DI 16 52 00.00 CS 16+89.21

FROMAT 4C. Spiral name, type 4, stored by way of D2 (degree curvature of the sharper curve, CS (curve-spiral point), DB (direction back), LS (length of spiral), and DA (direction ahead).



1] STORE SPIRAL name [2] D2 angle [3] CS *pa* [4] DB direction [5] LS length [6] DA direction

S SPI C4B D2 54 30 29.99 CS 32 DB N 30 26 00.00 W LS –300 DA N 39 04 29.99 E

OR

S SPI C4B D2 54 30 29.99 CS N 487005.8122 E 687548.0832 DB N 30 26 00.00 W LS –300 DA N 39 04 29.99 E

FORMAT 4D:
[1] STORE SPIRAL name [2] R2 radius [3] LS length [4] R1 radius [5] C2 *pb* [6] C1 *pa*

FORMAT 4E:
1] STORE SPIRAL name [2] R2 radius [3] CS *pa* [4] DB direction [5 LS length [6] R1 radius

Spiral Exercises give type and write a command lines for the for examples

What type is it and which format did you use?

1. **Given for spiral S1: TYPE? FORMAT?**
   Back Tangent or DB is N 40 25 33.00 E (TS to PIs)
   TS is stored point 100 N 526687.7617 E 743185.9021 Sta 0+00
   LS 400
   DEG 4
   The spiral angle is 8 00 (RT)

2. **Given for spiral S2: TYPE? FORMAT?**
   Length of spiral 300.00
   Back tangent CS to PIs (DB S 10 27 45.00 E)
   The curve to the spiral point (STACS) is N 527324.7289 E 742514.4865 Sta 30+00 point 104
   Radius is 900.00
   The spiral point of intersection is N 527226.1306 E 742532.6939 (105)
   Ahead tangent ST is N 527025.8643 E 742535.6861 (106)
   (overkill with information choose wisely)

3. **Given for spiral S3 TYPE? FORMAT?**
   Degree of incoming curve C4 is 1 00 00.00
   Degree of outgoing curve C5 is 4 00 00.00
   Length of spiral is 250
   Length of curve is 249.8731
   Curve to the spiral is point 115 at N 526712.4057 E 743786.6620 Sta 20+00
   Spiral to curve is point 116 at N 526481.5528 E 742691.0402 Sta 22+50

   Back tangent (PI of curve C4 to PIs of spiral S3) is S 20 00 00.00 W
   Angle 60 15 00 (RT)
   DEF 20 29 59.55
   LT 150.1194
   ST 100.1110
   Ahead tangent (PIs of spiral to PI of curve C5) S 26 15 00.00 W

4. given for spiral S4 TYPE? FORMAT?
D1 is 4 46 28.73
D2 is 7 09 43.10
LS 300
R1 1200.00
R2 800.00
Back tangent S 50 00 00.00 W
Ahead tangent S 32 05 42.25 W
CS N 528177.8725 E 741649.2919 Sta 50+00 (point 120)

SPIRAL-CURVE-SPIRAL COMMANDS

Store Spiral-Curve-Spiral Commands create and store three geometric elements: back-spiral, circular curve, and ahead spiral. The following naming convention is used in the output

Back Spiral: ***name*** **with a *B* appended**

Curve: ***name***

Ahead Spiral: ***name*** **with an *A* appended**

FORMAT:
[1] STORE SCS name [2] back tangent [3] LS length [4] element [5] ahead tangent

[2] The BACK TANGENT defined by one of 5 options:
OPTION 1. Back tangent defined by point of intersection PISCS and direction

PI *pa* DB direction

OPTION 2. Back tangent defined by point back PB and point of intersection PISCS

PB *pa* PI *pb*

OPTION 3. Back tangent defined by tangent-spiral point TS and direction back DB.

PB *pb* DB direction

OPTION 4. Back tangent defined by point back PB, direction back DB, distance TL from point back PB to tangent-spiral point TS.

PB *pa* DB direction TL distance

OPTION 5. Back tangent is defined by point back PB, direction back DB and distance TTL from point back PB to point of intersection PISCS

PB *pa* DB direction TTL distance

[3] LENGTH OF SPIRAL (LS) (3 OPTIONS)

OPTION 1. Back spiral and ahead spiral at equal lengths.

LS length

LS 300

OPTION 2. For unequal spirals.

LS1 length (back spiral length LS1)
LS2 length (ahead spiral length LS2)

LS1 300 LS2 400

[4]. ELEMENT

RADIUS radius or DEGREE angle
R 1164.456
Or DEG 34 64 35.2

[5] TANGENT AHEAD (4 OPTIONS)

OPTION 1. Ahead tangent is defined by the DA direction ahead

DA direction
DA N 32 25 48.7 E

OPTION 2. Ahead tangent define by point ahead PA

PA *pa*
PA 40

OPTION 3. Ahead tangent defined by delta angle to right

DEL angle (RT)
DEL 32 34 36.5

OPTION 4. Ahead tangent is defined by delta angle to left

DEL angle (LT)
DEL 25 28 22 LT

ADDITIONAL SPIRAL COMMANDS

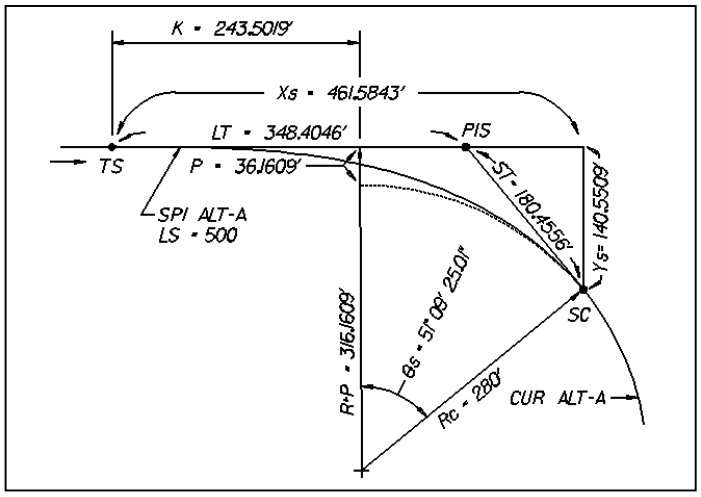
PRINT SPIRAL name. This command displays the spiral point values, coordinates and stations, and spiral element values.

LIST SPIRALS. This command will display names of all stored spirals in alphabetical order.

SPIRAL DATA. This command will calculate the geometric parameters for the named spiral given the length LS, [A] radius of spiral R1 and R2, or [B] degree of curvature D1 and D2.

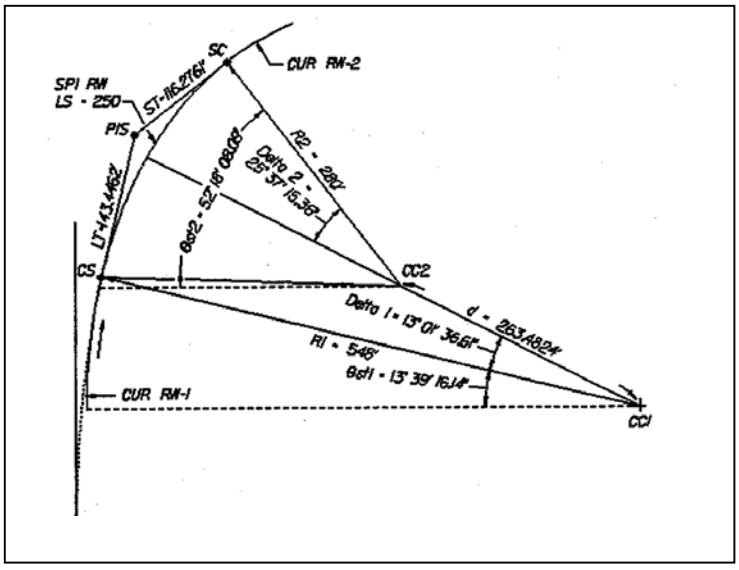
FORMAT A SPIRAL name R1 radius LS length R2 radius

SPI ALTA R1 0 LS 500 R2 280



Format B SPIRAL name D1 angle LS length D2 angle

SP1 S4B D1 10 27 19.56 LS 250 D2 20 27 46



EXERCISE FOR STORING SPIRAL-CURVE SPIRAL (SCS)
WRITE COMMANDS TO SHOW ALL SPIRALS

ASSUMME STORED POINTS 10, 20, 30, 40, 50, and 60
Point 10 is begin point
Point 60 is end point

WRITE STORE COMMANDS USING THE FOLLOWING INFORMATION
Points 20, 30, 40, 50 are points of intersection (PI)

10 to 20	**distance 1293.2114**	**direction N 16 52 32.01 E**
20 to 30	**distance 1964.4258**	**direction N 11 02 28.01 W**
30 to 40	**distance 2394.3203**	**direction N 04 34 00.00 W**
40 to 50	**distance 2401.7722**	**direction N 30 26 00.00 W**
50 to 60	**distance 1185.3892**	**direction N 39 04 29.99 E**

at 20 store (name=C1) a spiral-curve-spiral with back spiral 400 left, ahead spiral 300 left, degree 3 30, radius 1637.0223 and a total delta of 27 55 00.01

at 30 store (name=C2) a curve with radius 1637.0223 degree of curvature 0 30

at 40 store (name=C3) a spiral-curve-spiral with length of spiral 300, degree of curve 3 00, radius 1909.8593, spiral delta 4 30, and curve delta 16 52 00.00 left

At point of intersection 50, store (name=C4) a spiral curve spiral with length of spirals 300 right, and spiral delta 7 30, degree of curve 5 00, radius at 1145.9156, and curve delta 54 30 29.99 right.

If the SCS STORED at 40 is called C3
WRITE THE COMMAND TO STORE ONLY THE INGOING SPIRAL DATA

The reference to the GEOPAK manual, Part II, coordinate Geometry, Spiral Commands, Section 8